

Appl. No. 10/689,409
Reply to Office Action of June 4, 2007

Remarks

By this Amendment, Claims 1-19 are pending in this application. Claims 1 and 13 have been amended.

Claim Rejections - 35 USC § 102

In paragraph 4 of the Action, the Office has rejected Claims 1, 7, 13 and 20-22 as anticipated by U.S. Patent No. 5,526,446 to Adelson et al. (Adelson) under 35 USC 102(b).

The Federal Circuit has stated that "anticipation requires the disclosure in a single prior art reference of each element of the of the claim under consideration." *W.L. Gore & Assocs. V. Garlock*, 721 F.2d 1540, 220 USPQ 330 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984). However, it is not enough that the prior art reference disclose all the claimed elements in isolation. "Anticipation requires the presence in a single prior art reference disclosure of each and every element of the claimed invention, *arranged as in the claim*." *Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick Co.*, 730 F.2d 1452, 221 USPQ 481, 485 (Fed. Cir. 1984). "There must be no difference between the claimed invention and the reference disclosure, as viewed by a person of ordinary skill in the field of the invention." The Examiner has not met the burden of evidence of prima facie anticipation as will be shown below. Applicant respectfully submits that Claims 1, 7 and 13 include elements that have not been taught, disclosed or suggested by Adelson.

For example, Claims 1, 7 and 13 recite that a plurality of enhancement functions which are computed from a non-degraded reference image and one or more degraded images are "indexed...according to the degree of degradation of the degraded version of the reference digital image utilized to form the [subject] enhancement function."

Appl. No. 10/689,409
Reply to Office Action of June 4, 2007

The Office has stated that the term "coefficient" in Adelson reads on such "indexing" as claimed in the application (see *Office Action, para. 4*). Applicant respectfully submits that such a reading is at odds with the actual disclosures of Adelson.

In its common, everyday meaning, the term "index" refers to a value that identifies and is used to locate a particular element within a group. As such, the use of an index implies the existence of a characteristic relationship between the indexing scheme and a particular element which is indexed. In the present application, the indexing scheme results from correlating the degree of degradation of a given degraded version of the reference image (i.e. the index value) to the enhancement function (i.e. the indexed element) which results from the deconvolving of the degraded reference image with a non-degraded reference image. *See Detailed Description, para. 0091.*

Adelson's use of the term "coefficient" has no relation to the concept of indexing. Adelson states "in order to accomplish improved enhancement, a technique is provided to remove noise from images and to enhance their visual appearance through the utilization of a technique which *converts an image into a set of coefficients* in a multi-scale image decomposition process" (Adelson, col. 6, lines 1-5, emphasis added). In other words, the "coefficients" of Adelson are simply the **numerical representations of an image**. There is no mention in Adelson of any uses for such "coefficients" as either an indexing value or as an indexed element. Specifically, Adelson states that "the subject invention involves the derivation of a modifier which *when applied to a coefficient* of a multi-scale decomposition of an image results in enhanced noise rejection and thus an enhanced reconstructed image" (Adelson, col. 12, lines 57-61; Emphasis added). Such disclosure clearly indicates that there is no index-type relationship between the "coefficients" and the "modifiers" of Adelson. As such, Adelson fails to disclose "indexing each of the plurality of enhancement functions according to the degree of degradation of the degraded version of the reference digital image utilized to form the enhancement function" as recited in Claims 1, 7 and 13.

Appl. No. 10/689,409
Reply to Office Action of June 4, 2007

In order to further clarify this distinction, Claims 1, 7 and 13 have been amended to recite, specifically, "first" and "second" enhancement functions which are derived from and indexed according to "first" and "second" degraded versions of a reference image.

The Office has also indicated that it views step 34 of FIG. 1D (i.e. "multi-scale image decomposition") of Adelson as reading on the claim limitation of Claim 1 of "determining the degree of degradation of the new digital image." *Office Action*, para. 4. Applicant submits that a basis for such a reading is wholly absent from Adelson. With respect to step 34, Adelson specifically states that "splitting an image into a number of bands, more than just a highpass and a lowpass band, is referred to as a multi-scale decomposition in which the image is split into a number of adjacent spatial frequency bands, with processing or modification taking place on the information within these multiple bands or scales" (Adelson col. 2, line 65-col. 3, line 3).

Applicant respectfully submits that a process step comprising determining the degree of degradation of an image inherently entails some type of comparison to a non-degraded version of an image. As disclosed in the application, one method for making such a determination is through visual range verification (as recited in Claims 20-22).

The Office's assertion that the "multi-scale decomposition" of Adelson reads on a process step involving determining the degree of degradation simply does not follow as the decomposition is merely a transform of an image into a series of coefficients representing the frequency components of the image. (see Adelson col. 2, line 65-col. 3, line 3). There is no comparison of either the original image or the coefficient representation of the image to any reference. As such, a "degree of degradation" is not taught.

Further, Adelson specifically addresses the various manners in which an enhancement function may be calculated. Adelson states that "one [may

Appl. No. 10/689,409

Reply to Office Action of June 4, 2007

choose] the appropriate modification function which involves three possible approaches: a statistical analysis, a neural network approach, and a threshold-based approach" (Adelson, col. 8, lines 40-43). However, as described in Adelson, none of these approaches read on the index-based function selection of the present application.

Particularly, in the two-step statistical analysis method of Adelson, "in the analysis phase, one artificially degrades an image by adding noise and/or blurring it, and/or reducing its spatial resolution...[and] compares transform coefficients based on the degraded and undegraded images...This calculation results in a *function* which is stored in a look-up table...In the processing phase, a look-up table is used to apply the desired modification to estimate the undegraded image transform coefficient for each coefficient of the degraded image transform and its neighboring coefficients (Adelson, col. 8, line 51-col. Line 7)...*The goal of the look-up system described above is to approximate a multi-dimensional function which is described through a sampling of examples*" (Adelson col. 10, lines 2-5; emphasis added).

The Office has stated that the use of a look-up table necessarily "means that [the table] contains a plurality of functions." *Office Action, para. 4*. Such a conclusion is not valid. A lookup table, as is commonly recognized in the art, is simply a data structure, used to replace a runtime computation with a simpler lookup operation containing the *results* of multiple instances of those computations under varying input parameters. Conversely, a "function" is commonly recognized as a relation between two sets in which one element of the second set corresponds to each element of the first set as a result of some computation on the elements of the first set. There is no such relationship between a look-up table value and any other value *absent additional calculative steps* which are necessarily defined outside the scope of the look-up table. In the case of Adelson, the look-up table is used to provide transform coefficients which are multiplied with decomposition coefficients. However, the multiplicative nature of this calculation is not, itself, embodied in the look-up table. As such, the values

Appl. No. 10/689,409
Reply to Office Action of June 4, 2007

maintained in the look-up table can not be properly characterized as a "plurality of functions."

However, should the Office maintain its position that the look-up table of Adelson comprises a plurality of functions the Applicant further submits that Adelson is wholly silent with respect to the issue of selecting which of those "functions" are to be applied to a given image or, in the case of Adelson, decomposition coefficients. Adelson simply states that "in the processing phase a look-up table (LUT) is used to apply the desired modification to estimate the undegraded image transform coefficient from each coefficient of the degraded image transform" (Adelson, col. 9, lines 4-7). At no point does Adelson speak to what motivations dictate the identity of the "desired" modification. As such, Adelson fails to disclose "selecting a stored enhancement function having an index corresponding to a degree of degradation of a new digital image" as recited in Claim 1.

Pursuant to the above comments and amendments, the Applicant respectfully requests that the Office's rejections of Claims 1, 7 and 13 under 35 U.S.C. § 102 be withdrawn.

Claim Rejections - 35 USC § 103

Claims 3, 9, and 15 were rejected under section 103 as unpatentable over George (U.S. Patent No. 6,459,818) in view of Tsujita (U.S. Pat. No. 5,879,284) (Tsujita). Additionally, Claims 4, 10, and 16 were rejected under section 103 as unpatentable over George in view of Acharya (U.S. Pat. No. 6,459,818) (Acharya).

However, claims 3-4, 9-10, and 15-16 depend from allowable base claims 1, 7, and 13 respectively. Therefore, claims 3-4, 9-10, and 15-16 are patentably distinguishable from the combination of George, Tsujita and Acharya for at least the arguments given above.

Appl. No. 10/689,409
Reply to Office Action of June 4, 2007

Conclusion

In light of the forgoing, reconsideration and allowance of the claims is earnestly solicited. While it is believed that no extension of time or any other additional fees are necessary, the Commissioner is hereby authorized to grant any needed extension of time and to charge any additional fees which may be required for this Response, or credit any overpayment to Deposit Account No. 18-1722. If the Examiner feels that prosecution of present application would be assisted by a telephone interview, applicant encourages the Examiner to contact the applicant at the contact information listed below.

Respectfully submitted,

ROCKWELL COLLINS, INC.

Dated: 8/7/2007

By: Kyle Eppelle
Kyle Eppelle
Attorney for Applicant
Reg. No. 34,155

Kyle Eppelle
Rockwell Collins, Inc.
Intellectual Property Department
400 Collins Road NE M/S 124-323
Cedar Rapids, Iowa 52498
Telephone: 319-295-8280
Facsimile: 319-295-8777
Customer No. 26383